GENERAL VIEW OF THE MARTIAN METEORITES. K. Yanai, Department of Environmental and Planetary Sciences, Faculty of Engineering, Iwate University, 4-3-5, Ueda, Morioka, Iwate 020, Japan.

The SNC meteorite group is one of the most unique types of achondrites and is believed to have originated on Mars. Only 12 stones of SNC meteorites, including 6 Antarctic meteorites, are known to exist in almost 20,000 meteorite specimens in the world. They were originally classified into the following three groups according to their textures and mineral assemblages: Shergottites (S), Nakhlites (N), and Chassignites (C) collectively. Until now they have been well known as the "SNC meteorites" from Mars; however, they should be now grouped as "martian meteorites."

All the martian meteorites, except one specimen, are igneous rocks formed by magmatic crystallization on the parent planet Mars during recent history of 1 Ma–1.4 Ga. Most martian meteorites show a typical crystalline igneous texture such as cumulate, pikilitic, and gabbro-dolerite texture with intense shock. Only two specimens, ALH84001 and Y793605, show monomict breccia, but they appear to have been primarily crystallized from magma as crystalline igneous rock. ALH84001, especially, is orthopyroxene monomict breccia, indicating a remarkably old age of 4.5 Ga [1], and suggested some possibility of past life on Mars.

The reasons for suggesting that these meteorites originated on Mars are as follows: the ages are unusually younger than most meteorites; the rare (noble) gases within the martian meteorites chemically match those of Mars' atmosphere [2]; and the unique oxygen isotope compositions clearly isolate them from all other types of meteorites [3]. Some original data of the martian meteorites are shown in Table 1 with their textures, newly classified rock types, and their ages. The table shows 12 martian meteorites classified according to their textures, mineral assemblages, and bulk chemical compositions, such as dunite (Chassigny), ol-pyroxenite/ol-websterite (ALH77005, LEW88516, Y793605), wehrlite (Nakhla, Lafayette, Governador Valadares), gabbro-dolerite (EETA79001, QUE94201, Shergotty, Zagami), and orthopyroxenite (ALH84001).

The bulk chemical compositions of 10 meteorites, except those of Lafayette and QUE94201, were given by [4] and others. The chemical analyses have been done by various analytical methods, including the standard wet chemical analysis, X-ray fluorescence spectrometry, EPMA of fused beads, and others. The martian meteorites were also grouped

Table 1. Martian Meteorites.

Meteorite Name	Fall (Find)	Locality	Original Weight (g)	Texture	SNC Type Classification	Rock Type	Age (m.y.)
ALH77005	(1978)	Antarctica	482.5	Crystalline (Poikilitic)	Shergottite	Ol-Pyroxenite/ Ol-Websterite	~1400
ALH84001	(1984)	Antarctica	1,930.9	Monomict Br. (Cataclastic)	Shergottite	Orthopyroxenite	4560
Chassigny	Oct. 3 1915	France	~4,000	Cumulate (Coarse grain)	Chassignite	Dunite	~1400
EETA79001	(1979)	Antarctica	7,942.0	Gabbroic & Doleritic	Shergottite	Gabbro & Dolerite	~1400 150–240
Governador Valadares	1958	Brazil	158.	Cumulate (Preferred-Cpx)	Nakhlite	Wehrlite	
Lafayette	(1931)	U.S.A.	~800	Granular (Preferred-Cpx)	Nakhlite	Wehrlite	
LEW88516	(1988)	Antarctica	13.0	Crystalline (Coarse grain)	Shergottite	Ol-Pyroxenite/ Ol-Websterite	
Nakhla	Jun. 29, 1911	Egypt	~40,000	Cumulate (Preferred-Cpx)	Nakhlite	Wehrlite	~1300
QUE94201	(1994)	Antarctica	12.0	Doleritic	Shergottite	Dolerite	
Shergotty	Aug. 25, 1865	India	~5,000	Gabbroic (Coarse grain)	Shergottite	Gabbro	~1400 165–600
Y-793605	(1979)	Antarctica	~16	Monomict Br. (Poikilitc)	Shergottite	Ol-Pyroxenite/ Ol-Websterite	
Zagami	Oct. 3, 1962	Nigeria	~18,000	Gabbroic (Preferred-Px)	Shergottite	Gabbro	~1400 116–280

ALH: Allan Hills, EET: Elephant Moraine, LEW: Lewis Cliff, QUE: Queen Alexandra Range, Y: Yamato

chemically and named Chassigny (dunite) group, Yamato (ol-pyroxenite/ol-websterite) group, Nakhla (wehrlite), Shergotty (gabbro-dolerite) group, and ALH84 (orthryroxenite) group respectively. However, all groups, except Chassigny and ALH84, include some compositional varieties especially in Al_2O_3, MgO, and CaO, and those varieties were reflected in their mineral assemblages and mineral compositions.

The young age of the martian meteorites is the most conspicuous point in the extraterrestrial materials, because most meteorite ages indicate the earliest stage of the solar system. Most meteorites show 4.0–4.5 and >4.5-b.y.-old ages; however, martian meteorites indicate very young ages. The youngest age of 116 m.y. old has been determined by the Sm-Nd method, and several martian meteorites range in agefrom 116 to 600 m.y. old when measured by different dating methods [5]. On the other hand, 1400 million ages are acceptable as the age of the igneous activity (crystallization of magma) that originally produced the martian rocks (meteorites) on Mars' surface. However, ALH84001 indicates the very old age of 4.56 b.y. This old age might indicate that ALH84001 represents the old primitive crust of Mars, the same as those of other primitive achondrite meteorites.

References: [1] Nyquist L. et al. (1995) *LPS XXVI*, 1065–1066. [2] Bogard D. D. and Johnson P. (1984*) Science, 221*, 651–654. [3] Clayton R. N. and Mayeda T. K. (1983) *EPSL, 62*, 1–6. [4] Yanai K. and Kojima H. (1995) Cataloge of the Antarctic Meteorites, 211p. *Natl. Inst. Polar Res., Tokyo.* [5] Jones J. H. (1986) *GCA, 50*, 969–977.